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Indian Standard
METHOD FOR COMPUTATION OF
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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

METHOD FOR COMPUTATION OF CAPACITY TABLES FOR VERTICAL OIL STORAGE TANKS

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NEW DELHI 110002

Indian Standard

METHOD FOR COMPUTATION OF CAPACITY TABLES FOR VERTICAL OIL STORAGE TANKS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 3 October 1961, after the draft finalized by the Petroleum Measurements Sectional Committee had been approved by the Chemical Division Council.

0.2 The problem of accurate measurement of bulk quantities of liquid petroleum products is not a simple one. Its solution involves accurate engineering and mathematical work, the skill of the experienced oil gauger, and the use of carefully standardized and calibrated equipments. Accuracy in measurement is essential in the sale, purchase and handling of oil. It not only obviates possible disputes between the buyer and the seller but it also provides the only reliable means of maintaining adequate control over storage and distribution losses.

0.3 The measurement of bulk quantities of liquid petroleum products involves various processes such as temperature measurement, calibration and computation of capacity tables of tanks and gauging of tanks, and calculation of bulk quantities of oils in tanks. The need for accurate compilation of capacity tables of tanks cannot, therefore, be overemphasized. The object of this standard is, therefore, to lay down methods to be adopted uniformly in the country.

0.4 Taking into consideration the views of the producers, distributors, technologists and consumers, the Sectional Committee responsible for the preparation of this standard, felt that it should be related to the prevailing trade practices in the country in this field. Furthermore, due weightage had to be given to the need for international co-ordination among standards prevailing in different countries of the world in this field. These considerations led the Sectional Committee to base this standard on Petroleum Measurement Manual issued by the Institute of Petroleum (IP), London in 1952.

0.5 Metric system has been adopted in India and all quantities and dimensions have been given in this system.

0.6 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS:2-1960 Rules for Rounding Off Numerical Values (*Revised*).

1. SCOPE

1.1 This standard prescribes the methods of computation of capacity tables for vertical storage tanks intended for bulk storage of petroleum and liquid petroleum products.

2. GENERAL

2.1 The calculations shall be made in accordance with accepted mathematical principles.

2.2 At the head of each capacity table it shall be clearly stated that the dip/capacity relationship applies only to dips taken at one specified point. This point shall be clearly marked on the tank, and the height of the dipping reference point shall be recorded at the head of the capacity table.

3. FORM OF TANK TABLES

3.1 Provided that tank tables have been prepared in accordance with the principles laid down in this standard, the form in which the table is set out will not alter the accuracy of the figures obtained from it, but the following principles shall be applied in preparing the tank tables:

- a) The intervals of dip at which the tables are set out shall not be so great that interpolation for intermediate dips is difficult. It is convenient to set out tables at intervals of dip not greater than 5 cm, for then a small proportional parts table, calculated on the average content of the tank per unit depth, may be used for calculating the litres corresponding to intermediate decimal dips. In the case of lap joints, however, the proportional parts table should be set out for every course (ring). Levels affected by bottom irregularities and deadwood shall not be included in calculating the average capacity per unit depth used for the proportional parts table; and this table shall not be applied in interpolations at these levels.
- b) The tables may be set out more fully; this may be justifiable in some cases where the greatest speed in calculation is desired, but it shall be remembered that a table set out on a single sheet of paper is often quicker in use than one which occupies several pages.
- c) It should be remembered that, at best, no oil measurement can be relied upon to nearer than one part in 10 000. Commercial tables should never be set out to show any fractions of a litre, and minor discrepancies within this limit shall be disregarded.
- d) In general, therefore, it is recommended that tables should be set out to show litres at intervals of 5 cm in dip with a proportional parts table for intermediate dips, the latter being set out against millimetres.
- e) A recommended format of a calibration chart for butt welded tanks is given in Appendix A.

SECTION I STRAPPING METHOD

4. CORRECTIONS TO BE APPLIED TO MEASURED CIRCUMFERENCES

4.1 Step-Overs

4.1.1 For each obstruction the excess or deficiency of the tape measurement spanning the obstruction as compared with the step-over interval for the course (ring) concerned shall be subtracted from or added to the circumference figure obtained by strapping, and the result shall be taken as the corrected circumference, free from error due to the displacement of the tape from its proper path by the obstructions concerned.

4.1.2 Step-over correction shall be included for all vertical seams where it is detectable. In the case of vertical seams, provided that the tape path used was entirely clear of rivet heads, an average step-over correction may be determined for each course (ring) and multiplied by the number of seams per course (ring) to obtain the total correction to be applied to the measured circumference of that course (ring) to compensate for such overlaps.

4.1.3 For single obstructions, only step-over corrections 2 mm or over shall be included.

4.1.4 The use of the step-over corrects circumferences for the effect on them of vertical seam overlaps but does not correct the tank tables for the effect as deadwood of internal projection of the seam edges. These shall be computed and accounted for as deadwood.

4.1.5 By choosing tape courses in order to avoid appurtenances, use of step-overs could be eliminated to a great extent.

4.2 Plate Thickness—Plate thicknesses measured shall be converted to the nearest 0.1 mm.

4.3 Temperature Correction—Where the strapping and dipping tapes are calibrated at 20°C, and the tank table is to be corrected for use with the shell at 15°C, from each measured circumference shall be subtracted 0.000 09 times the measured circumference, before the figure is taken into further calculation.

5. CALCULATIONS

5.1 The mean external circumference of any course (ring) shall be the average of the circumferences measured on it and corrected to the nearest 0.1 mm.

5.2 The mean internal circumference of the course (ring) shall then be calculated from the mean external circumference of the course (ring) by subtracting from the latter 2π times the plate thickness in metres.

5.3 The open capacity of each course (ring), that is its capacity without allowing for deadwood shall be calculated as if the course (ring) were a true cylinder of the mean internal circumference determined as under 5.2. This rule shall apply to vertical cylinders of in-and-out, telescopic or shingled construction.

5.4 The open capacity of each course (ring) in litres per centimetre of height shall be obtained by using either the following formula or any other mathematically equivalent process:

$$\text{Open capacity in litres per centimetre} = \frac{C^2 \times 10\,000}{4\pi \times 1000.028} \quad \text{or} \quad 0.795\,752 \times C^2$$

where

C = the mean internal circumference in metres.

5.5 For tanks which are inclined to the vertical, these formulæ shall be modified as given in Appendix B.

5.6 Specimen calculations are given in Appendix C.

SECTION II INTERNAL MEASUREMENT METHOD

6. CORRECTIONS TO BE APPLIED TO DIAMETER MEASUREMENTS

6.1 Deductions shall be made from the average tap readings obtained in measuring diameters to allow for the effect of sag. The correction Z for sag expressed in metres is given by the formula:

$$Z = \frac{W^2 S^3}{24 P^3} = K S^3$$

where

P = pull on tape in kg,

S = span of tape in m,

W = weight of tape in kg/m, and

$$K = \frac{W^2}{24 P^3} = \text{constant.}$$

Example:

For a tape 10 mm wide and 0.25 mm thick, made of steel of density 7 850 kg/m³, values of K to give the correction in centimetres when the tape is stretched with flat side horizontal, will be:

P	K
4.4 kg	8.29×10^{-6}
4.5 kg	7.92×10^{-6}
4.6 kg	7.58×10^{-6}

The above formula gives practically the same results as the equation of the catenary and is less cumbersome.

6.2 To the average diameter of each course (ring), corrected for sag, add the length of the dynamometer when registering a pull of 4.5 kg.

6.3 Corrections for the effect of stretch are unnecessary because the tension applied is that at which the tape is standardized.

6.4 Corrections for temperature shall be made as specified in 7.3.

7. CALCULATIONS

7.1 The mean diameter measurement will consist of the average, of the separate tape readings corrected for sag, plus the length of the dynamometer.

7.2 The procedure shall, therefore, be:

- a) Average the tape readings obtained for each course (ring), by dividing the sum of all these readings on the course (ring), by their number. Round off this average to the nearest 0.1 mm.
- b) Correct the mean result of (a) for sag as specified in 6.1.
- c) Add to the result of (b) the dynamometer length as specified in 6.2.

7.3 Where the measuring and dipping tapes are calibrated at 20°C, and the tank table is to be correct for use with the shell at 15°C, multiply the result obtained in 7.2 (c) by (1—0.000 09), before the figure is taken into further calculation. Round off this figure to the nearest 0.1 mm.

7.4 Calculate the open capacity of each course (ring), that is its capacity, without allowing for deadwood, as if the course (ring) were a true cylinder of the mean internal diameter determined under 7.2. This rule shall apply to vertical cylinders of in-and-out, telescopic or shingled construction.

7.5 The open capacity of each course (ring), in litres per centimetre of height shall be obtained by using the following formula or by any other mathematically equivalent process:

$$\frac{D^3 \times \pi}{1\,000 \cdot 028 \times 4} \text{ or } 0.000\,785\,376 \times D^3$$

where

D = the mean internal diameter in centimetres.

7.6 For tanks which are inclined to the vertical, modify these formulae as given in Appendix B.

7.7 When the level or levels from which oil depths will be measured differ from the datum level from which the tank table is first prepared, correction for difference shall be made in the final table.

7.8 Specimen calculations are given in Appendix D.

8. DEADWOOD

8.1 The open capacity of each course (ring) shall be adjusted for any deadwood it contains.

8.2 The total volume of each piece of deadwood shall be calculated to the nearest litre. In this context, the term 'piece of deadwood' shall include such items as the rivet heads in one line around the tank, taken collectively, as a single 'piece' of deadwood.

8.3 The effect of small pieces of deadwood may be neglected provided that (a) the total effect of any such neglect shall not lead to error in the tank tables exceeding 0.005 percent of the total capacity of the course (ring) in which the deadwood occurs, and (b) any deadwood so neglected is distributed evenly, or substantially so, over the whole height of the course (ring). In calculating the table, however, it shall be permissible to include the effect of any deadwood, however small.

9. TANK BOTTOMS

9.1 When the tank bottom is substantially horizontal, for example, when the tank is carried on a level concrete raft or steel structure, then bottom irregularities can be neglected.

9.2 When the tank bottom has been calibrated by measuring in suitable known volumes of liquid, the tank table for these levels shall be prepared from these measurements on sound mathematical principles. The highest level and capacity shown in the tank bottom calibration table so prepared shall then be the datum level and capacity from which is to be constructed the rest of the table should be prepared by calculation as described in this section.

10. FLOATING-ROOF TANKS

10.1 Except for the following modifications, tables shall be prepared in accordance with Section I and Section II.

10.1.1 Allowance for deadwood shall be made as described in 8.

10.1.2 The drain line and other accessories attached to the underside of the roof shall be included as fixed deadwood in the position they occupy when the roof is at rest on its supports. The position of these accessories should be specified in the calibration table.

10.1.3 Two levels shall be defined, both an exact number of centimetre above the datum point from which dip readings will be taken. The first level, designated *A*, shall be not less than 4 cm and not more than 6 cm below the lowest point of the roof plates when the roof is at rest. The second level, designated *B*, shall be not less than 4 cm and not more than 6 cm above the free oil surface when the roof is at its lowest oil borne position.

10.1.4 The floating weight of the entire roof shall include weight of roof plus half the weight of the rolling ladder and other hinged and flexibly supported accessories that are carried up and down in the tank with the roof. The displaced volume due to roof weight can be easily calculated from:

$$\frac{\text{roof weight} \cdot \text{in kg}}{\text{Density of the stock in kg/litre at tank temperature}}$$

This displacement, minus the volume of deadwood already accounted for in 10.1.2, shall be considered as an item of deadwood applicable to all levels above *B*. It shall either be entered as such on a supplementary table or taken into account in the preparation of the final table as a deduction for deadwood at all levels above *B*. For levels between *A* and *B*, the proportion of roof displacement to be taken into account as deadwood may be calculated from the dimensions of the floating roof. These partial displacements shall either be entered as such in the supplementary table as applicable for levels between *A* and *B*, or taken into account in preparation of final table. Alternatively, where measured quantities of oil have been admitted to the tank and corresponding levels of the free oil surface determined by dipping, the necessary adjustments to the tank capacity within the range of the level *A* and *B* may be computed from this data. *The part of the table between level A and level B shall be marked 'not accurate'.*

10.1.5 It is considered impracticable to allow in the tank table, for the effects of extraneous matter retained by the roof, varying friction of the roof shoes and varying immersion of roof supports.

APPENDIX A

[Clause 3.1 (e)]

RECOMMENDED FORMAT OF A CALIBRATION CHART FOR BUTT WELDED TANKS

Proportional Parts	Tank No.
	Code
	Type
	Dia or Circumference
	Height

mm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres	cm	Litres
1		00		200		400		600		800		1 000		1 200		1 400			
2		05		05		05		05		05		05		05		05			
3		10		10		10		10		10		10		10		10			
4		15		15		15		15		15		15		15		15			
5		20		20		20		20		20		20		20		20			
6		25		25		25		25		25		25		25		25			
7		30		30		30		30		30		30		30		30			
8		35		35		35		35		35		35		35		35			
9		40		40		40		40		40		40		40		40			
10		45		45		45		45		45		45		45		45			
11		50		250		450		650		850		1 050		1 250		1 450			
12		55		55		55		55		55		55		55		55			
13		60		60		60		60		60		60		60		60			
14		65		65		65		65		65		65		65		65			
15		70		70		70		70		70		70		70		70			
16		75		75		75		75		75		75		75		75			
17		80		80		80		80		80		80		80		80			
18		85		85		85		85		85		85		85		85			
19		90		90		90		90		90		90		90		90			
20		95		95		95		95		95		95		95		95			
21		100		300		500		700		900		1 100		1 300		1 500			
22		05		05		05		05		05		05		05		05			
23		10		10		10		10		10		10		10		10			
24		15		15		15		15		15		15		15		15			
25		20		20		20		20		20		20		20		20			
26		25		25		25		25		25		25		25		25			
27		30		30		30		30		30		30		30		30			
28		35		35		35		35		35		35		35		35			
29		40		40		40		40		40		40		40		40			
30		45		45		45		45		45		45		45		45			
31		150		350		550		750		950		1 150		1 350		1 550			
32		55		55		55		55		55		55		55		55			
33		60		60		60		60		60		60		60		60			
34		65		65		65		65		65		65		65		65			
35		70		70		70		70		70		70		70		70			
36		75		75		75		75		75		75		75		75			
37		80		80		80		80		80		80		80		80			
38		85		85		85		85		85		85		85		85			
39		90		90		90		90		90		90		90		90			
40		95		95		95		95		95		95		95		95			

Data regarding strapping, dimensions, etc.

Approved by

Signature

Date

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APPENDIX B*(Clauses 5.5 and 7.6)***COMPUTATION OF CONTENTS OF TANKS INCLINED
TO THE VERTICAL****B-1. TANKS INCLINED TO THE VERTICAL**

B-1.1 Capacity as determined in 5.5 and 7.5 applies to tanks which are vertical. For tanks inclined to the vertical at an angle θ , the open capacity in litres per centimetre of vertical height, is given by:

$$0.795\,752 \times C^2 \times \sec \theta$$

where C = the mean internal circumference in metres,

OR

$$0.000\,785\,376 \times D^2 \times \sec \theta$$

where D = the mean internal diameter in centimetres.

Sec θ may be ignored for angles of tilt up to 1 in 50, this representing a maximum error of 0.02 percent.

B-1.1.1 The correction specified above shall be applied before the corrections for deadwood are made.

APPENDIX C*(Clause 5.6)***EXAMPLE FOR STRAPPING METHOD****C-1. DATA OBTAINED BY STRAPPING**

COURSE (RING) No.	MEASURED EXTERNAL CIRCUM- FERENCES metres	STEP-OVER CORRECTIONS metres	PLATE THICK- NESS mm	INTERNAL HEIGHTS OF COURSES (RINGS)	
				Individual cm	Cumulative cm
8 Top	113.040	0.002	7 }	187.0	1 475.0
8 Middle	113.086	0.002	7 }		
8 Bottom	113.085	0.002	7 }		
7 Top	113.127	0.002	7 }	179.0	1 288.0
7 Middle	113.133	0.002	7 }		
7 Bottom	113.130	0.002	7 }		
6 Top	113.090	0.003	10 }	190.0	1 109.0
6 Middle	113.096	0.003	10 }		
6 Bottom	113.092	0.003	10 }		

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COURSE (RING) No.	MEASURED EXTERNAL CIRCUM- FERENCES metres	STEP-OVER CORRECTIONS metres	PLATE THICK- NESS mm	INTERNAL HEIGHTS OF COURSES (RINGS)	
				Individual cm	Cumulative cm
5 Top	113.152	0.004	13	179.0	919.0
5 Middle	113.160	0.004	13		
5 Bottom	113.155	0.004	13		
4 Top	113.085	0.010	13	191.0	740.0
4 Middle	113.092	0.010	13		
4 Bottom	113.090	0.010	13		
3 Top	113.175	0.010	16	178.0	549.0
3 Middle	113.176	0.010	16		
3 Bottom	113.170	0.010	16		
2 Top	113.077	0.013	18	191.0	371.0
2 Middle	113.081	0.013	18		
2 Bottom	113.075	0.013	18		
1 Top	113.187	0.015	20	180.0	180.0
1 Middle	113.189	0.015	20		
1 Bottom	113.175	0.015	20		

C-2. ADDITIONAL DATA

a) Deadwood

COURSE (RING) No.	APPLICABLE HEIGHT cm	DEADWOOD		TOTAL DEAD- WOOD IN COURSES l
		l	l/cm	
8	1 466 to 1 475	— 350	— 38.889	— 3 194
8	1 415 „ 1 466	— 508	— 9.961	
8	1 350 „ 1 415	— 2 336	— 35.938	
8	1 288 „ 1 350	nil	nil	
7	1 109 „ 1 288	nil	nil	
6	919 „ 1 109	nil	nil	— 195
5	740 „ 919	nil	nil	
4	549 „ 740	— 195	— 1.021	
3	371 „ 549	— 259	— 1.455	
2	180 „ 371	— 309	— 1.618	
1	107 „ 180	— 145	— 1.986	— 300
1	51 „ 107	+ 59	+ 1.054	
1	46 „ 51	— 36	— 7.200	
1	0 „ 46	nil	nil	

b) Tape calibration temperature — 20°C

c) Condition of tank at time of strapping:

Water in tank to depth of

Water temperature

Density of water at 20°C

1 400 cm

20°C

1.000 kg/l

C-3. CALCULATION OF CORRECTED INTERNAL CIRCUMFERENCES**Course (Ring) No. 8 Top**

Measured external circumference at 20°C	113·040 0 m
Correction for calibration temperature of tape	—0·010 2 m
Calculated external circumference at 15°C	113·029 8 m
Step-over correction	—0·002 0 m
Correction for plate thickness $7 \times 6 \cdot 283$ 2 mm	—0·044 0 m
Corrected internal circumference	<u>112·983 8 m</u>

(Calculation for other courses may be done in a similar way)

The corrected internal circumferences for the remaining measurements given above are shown below.

C-4. CALCULATION OF OPEN CAPACITY OF COURSES (RINGS)

COURSE (RING) No.	CORRECTED INTERNAL CIRCUMFERENCE m	MEAN INTERNAL CIRCUMFERENCE m	OPEN CAPACITY OF COURSE (RING)	
			l/cm	l
8 Top	112·983 8	113·014	10 163·48	1 900 571
8 Middle	113·029 8			
8 Bottom	113·029 8			
7 Top	113·070 8	113·073 8	10 174·22	1 821 185
7 Middle	113·076 8			
7 Bottom	113·073 8			
6 Top	113·014 0	113·016 7	10 163·95	1 931 150
6 Middle	113·020 0			
6 Bottom	113·016 0			
5 Top	113·056 1	113·059 8	10 171·70	1 820 734
5 Middle	113·064 1			
5 Bottom	113·059 1			
4 Top	112·983 1	112·987 1	10 158·62	1 940 296
4 Middle	112·990 1			
4 Bottom	112·988 1			
3 Top	113·054 3	113·053 0	10 170·48	1 810 345
3 Middle	113·005 3			
3 Bottom	113·049 3			
2 Top	112·940 7	112·941 4	10 150·41	1 938 728
2 Middle	112·944 7			
2 Bottom	112·938 7			
1 Top	113·036 1	113·032 8	10 166·84	1 830 031
1 Middle	113·038 1			
1 Bottom	113·024 1			
			TOTAL	14 993 040

C-5. CALCULATION OF NET CAPACITY OF COURSES (RINGS)

OIL DIP cm	OPEN CAPACITY l/cm	DEADWOOD l/cm	NET CAPACITY l/cm
0 to 46	10 166·84	nil	10 166·84
46 „ 51	10 166·84	-7·20	10 159·64
51 „ 107	10 166·84	+1·05	10 167·89
107 „ 180	10 166·84	-1·99	10 164·85
180 „ 371	10 150·41	-1·62	10 148·79
371 „ 549	10 170·48	-1·46	10 169·02
549 „ 740	10 158·62	-1·02	10 159·60
740 „ 919	10 171·70	nil	10 171·70
919 „ 1 109	10 163·95	nil	10 163·95
1 109 „ 1 288	10 174·22	nil	10 174·22
1 288 „ 1 350	10 163·48	nil	10 163·48
1 350 „ 1 415	10 163·48	-35·94	10 127·54
1 415 „ 1 466	10 163·48	- 9·96	10 153·52
1 466 „ 1 475	10 163·48	-38·89	10 124·59

A P P E N D I X D*(Clause 7.8)***EXAMPLE FOR INTERNAL MEASUREMENT METHOD****D-1. DATA OBTAINED BY INTERNAL MEASUREMENT**

D-1.1 In this example it is assumed that the same tank as in Appendix C has been calibrated by internal measurement. The means of each course (ring) of the tape measurements of the internal diameters are as in col 2 of the table D-4.

Dynamometer length at a tension of 4·5 kg = 21·30 cm

D-2. ADDITIONAL DATA

D-2.1 All course (ring) heights deadwood, etc, are the same as in Appendix C.

D-3. SAG CORRECTION

D-3.1 For a tension of 4·5 kg, the sag correction for course (ring) No.1 is
 $7·89 \times 10^{-6} \times (35·787\ 8)^3 = 3·61\text{ cm.}$

D-4. CALCULATION OF CORRECTED INTERNAL DIAMETER

Course (Ring) No. 1

Mean tape reading	3 578.78 cm
Sag correction (deduct)	3.61 cm
Corrected tape reading	3 575.17 cm
Dynamometer length (add)	21.30 cm
Measured internal diameter at 20°C	3 596.47 cm
Correction for calibration temperature of tape (deduct)	0.32 cm
Corrected internal diameter at 15°C	3 596.15 cm

The corresponding tape readings and corrected internal diameters calculated as shown above, for all courses (rings) are tabulated below:

COURSE (RING) No.	MEAN TAPE READING	MEAN TAPE READING CORRECTED FOR SAG AND DYNAMOMETER	MEAN INTERNAL DIAMETER CORRECTED FOR TAPE CALIBRATION TEMPERATURE
(1)	(2)	(3)	(4)
	cm	cm	cm
8	3 579.75	3 597.44	3 597.12
7	3 580.92	3 598.61	3 598.29
6	3 578.90	3 596.59	3 596.27
5	3 580.12	3 597.81	3 597.49
4	3 577.50	3 595.20	3 594.88
3	3 579.47	3 597.26	3 596.84
2	3 576.95	3 593.65	3 593.33
1	3 578.78	3 596.47	3 596.15

D-5. CALCULATION OF OPEN CAPACITY OF COURSES (RINGS)

COURSE (RING) No.	OPEN CAPACITY OF COURSE (RING)	OPEN CAPACITY OF COURSE (RING)
	1/cm	1
8	10 162.17	1 900.326
7	10 168.79	1 820.213
6	10 157.37	1 929.900
5	10 164.27	1 819.404
4	10 149.52	1 938.558
3	10 160.59	1 808.585
2	10 140.77	1 936.887
1	10 156.69	1 828.204
	TOTAL	14 982.077

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D-6. CALCULATION OF NET CAPACITY OF COURSE (RING)

OIL DIP cm	OPEN CAPACITY l/cm	DEADWOOD l/cm	NET CAPACITY l/cm
0 to 46	10 156·69	nil	10 156·69
46 „ 51	10 156·69	-7·20	10 149·49
51 „ 107	10 156·69	+1·05	10 157·74
107 „ 180	10 156·69	-1·99	10 154·70
180 „ 371	10 140·77	-1·62	10 139·15
371 „ 549	10 160·59	-1·46	10 159·13
549 „ 740	10 149·52	-1·02	10 148·50
740 „ 919	10 164·27	nil	10 164·27
919 „ 1 109	10 157·37	nil	10 157·37
1 109 „ 1 288	10 168·79	nil	10 168·79
1 288 „ 1 350	10 162·17	nil	10 162·17
1 350 „ 1 415	10 162·17	-35·94	10 126·23
1 415 „ 1 466	10 162·17	- 9·96	10 152·21
1 466 „ 1 475	10 162·17	-38·89	10 123·28

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